Comparison of separation method (cold-ethanol or water) on the functional properties of freeze-dried vital wheat gluten

BIOPRODUCT CHEMISTRY and ENGINEERING RESEARCH

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Abstract:

Vital wheat gluten is commonly added to wheat flour to improve mixing and baking performance of dough. The objective of this research was to evaluate the mixing and gluten-ball baking performance of laboratory-produced, freeze-dried vital wheat gluten produced by alternative technologies. Two batter-like methods were applied to prepare the gluten from a bread-type flour with 13% protein: one method employed water as the starch displacement fluid and the other cold ethanol. Gluten from the water method is noted as W-gluten and that from the cold-ethanol method is noted as CE-gluten. W and CE-vital gluten was added to flour with 9.2% protein from a club wheat, Moro, reconstituted with water, and evaluated using a 10g-farinograph and the 10g-mixograph, or directly reconstituted and baked to produce an expanded ball. In general, CE gluten was more effective in improving farinograph stability, mixing tolerance, and absorption; and in improving mixograph resistance. For instance, for fortification up to 13%P the marginal increase in farinograph stability was 1.3 min/%P for W-gluten and 2.0 min /%P CE-gluten. At least comparable baked gluten ball expansions were obtained, but the results were dependent on the degree of mixing and water absorption. The results suggest improved functional performance for gluten produced by the cold-ethanol method relative to that produced by conventional aqueous methods.

Objective:

Determine quality of vital wheat gluten produced by displacement of starch with water and cold-ethanol. Quality was assessed for freeze dried gluten to eliminate thermal denaturation.

Methodology:

1 Wheat gluten was produced by a batter-like method in which a developed batter was stirred into excess water or cold ethanol and then collected on a screen and drained. This led to a condensed ball (W-Gluten at right top) or a fibrous mass (CE gluten at right bottom). Gluten produced by this method was frozen and freeze dried in a laboratory freeze drier. The freeze-dried gluten was evaluated (a) on a farinograph, (b) on a mixograph , and (c) in baked gluten ball tests. Standard published methods were used as reported or slightly modified.

Results:

2 Microfarinograph A: A Microfarinograph was applied to a dough from a club wheat (Moro) flour that was fortified from its native protein at 9% up to 15% with the two gluten types (W-gluten left, CE-gluten right). Examples for gluten fortification at 10.9% (top) and 13% (bottom) are shown. Each figure includes an overlay (in outline) of the original Moro flour.

3 Microfarinograph B: Parameters from the farinographs of A are summarized for protein content up to nearly 15%.

4 Mixograph: The mixograph was applied to moro flour fortified to15% total P with W and CE-gluten. In addition a purified flour was made with gluten and starch (Sigma) only (synthetic), with the starch washed from the gluten (reconstituted), and with the starch washed using the comparison method (reconstituted/swapped starch).

5 Baked gluten balls: Gluten balls were prepared by baking rehydrated gluten in an oven using a modified ball baking procedure. Samples are shown with same development time

6 Mixograph of rehydrted, concentrated W-gluten and CE- gluten (70% protein) as produced by the separtion methods above..

Conclusions:

We present evidence for the equivalence between water and cold-ethanol produced gluten immediately following separation and after freeze drying and rehydration. In mixing studies of fortified flour dough the result achieved with W-gluten could be achieved with less CE gluten suggesting a higher quality. Baked gluten ball expansions were to comparable volumes. The most significant difference between gluten types was observed in the mixograph tests of rehydrated gluten. In the mixograph CE-gluten was stronger (peak height and width) and more tolerant to mixing.

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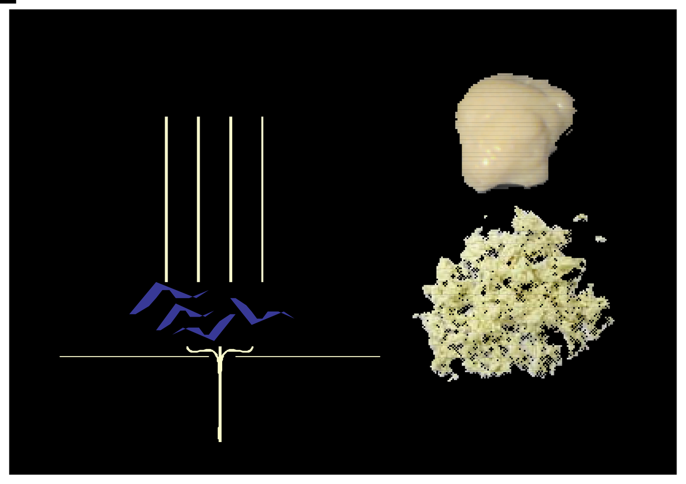

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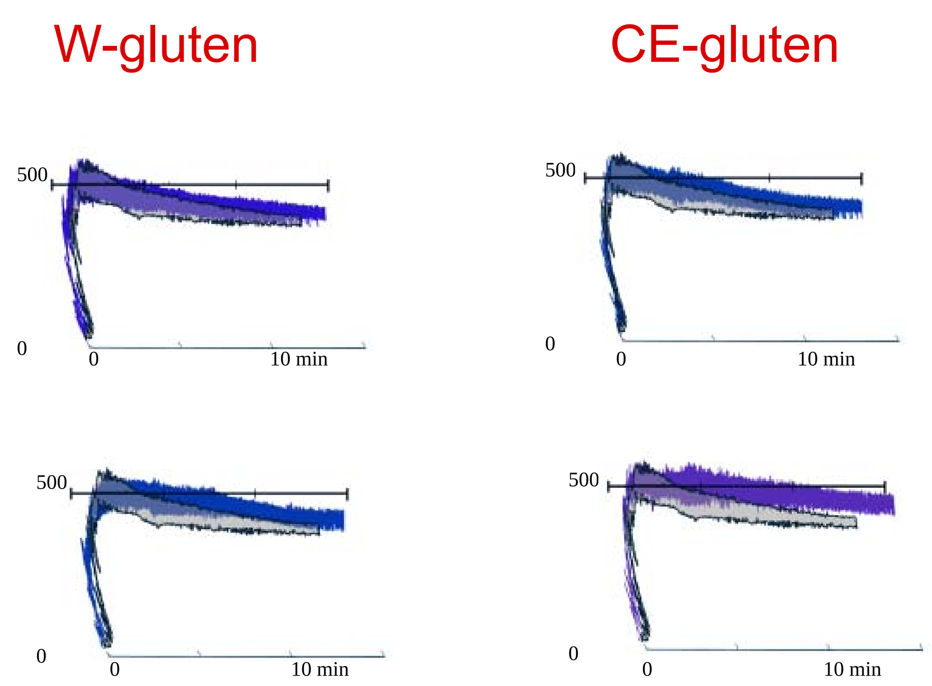

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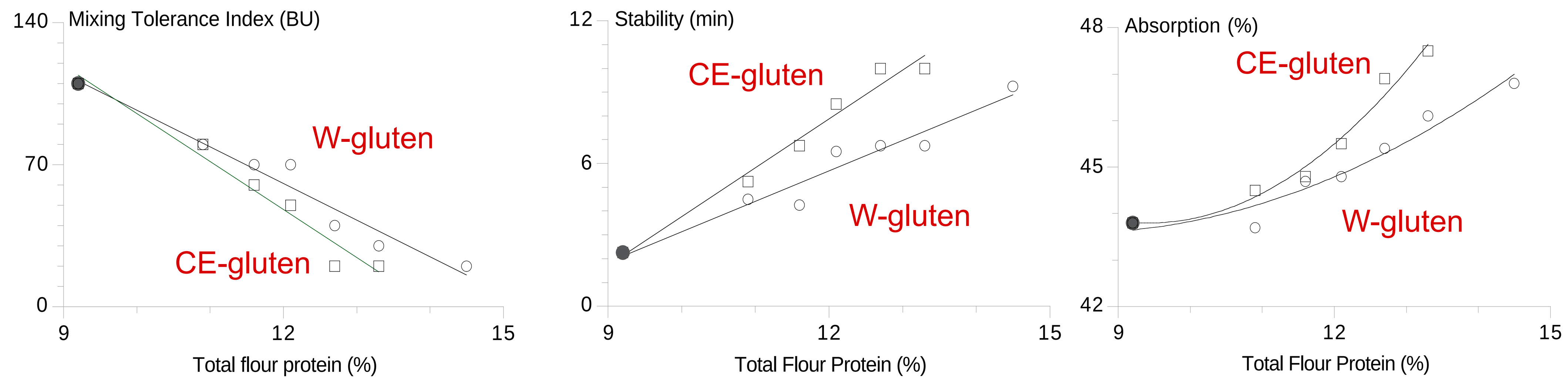

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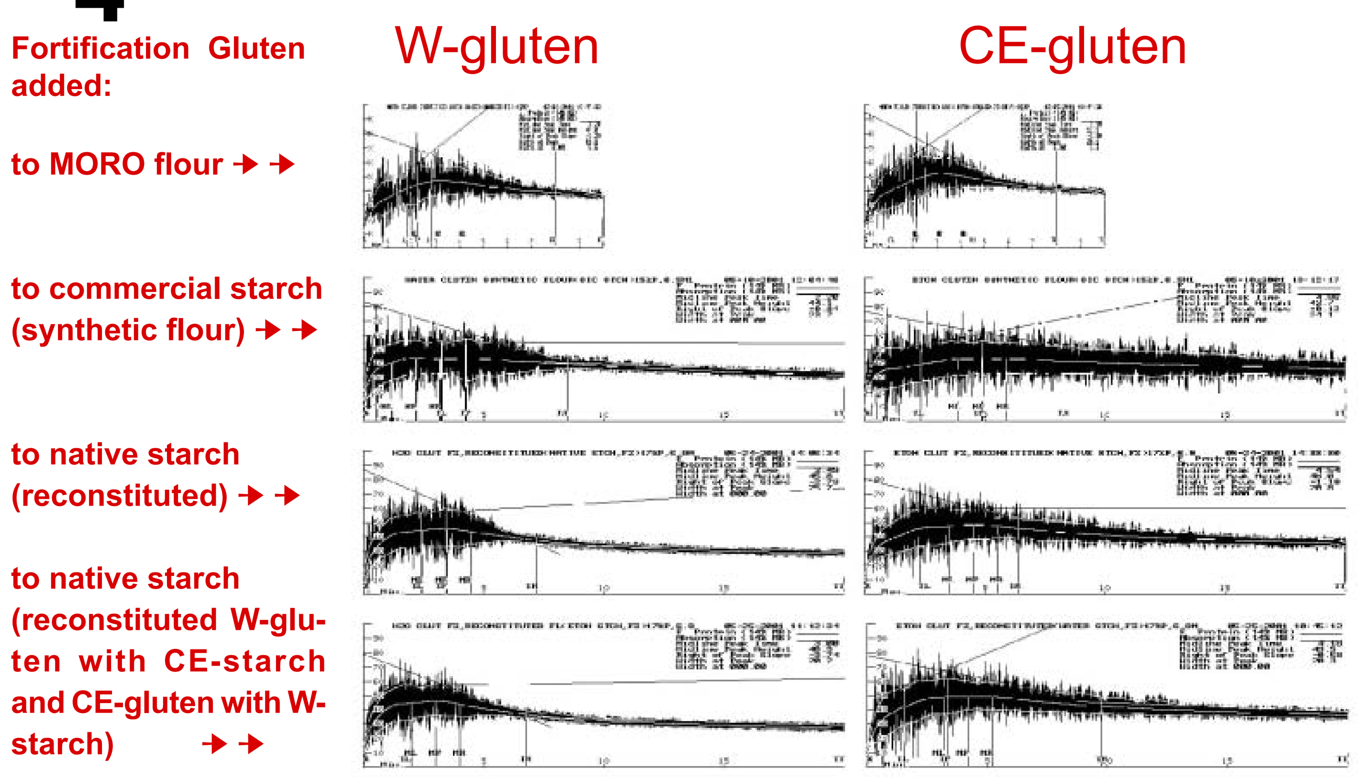

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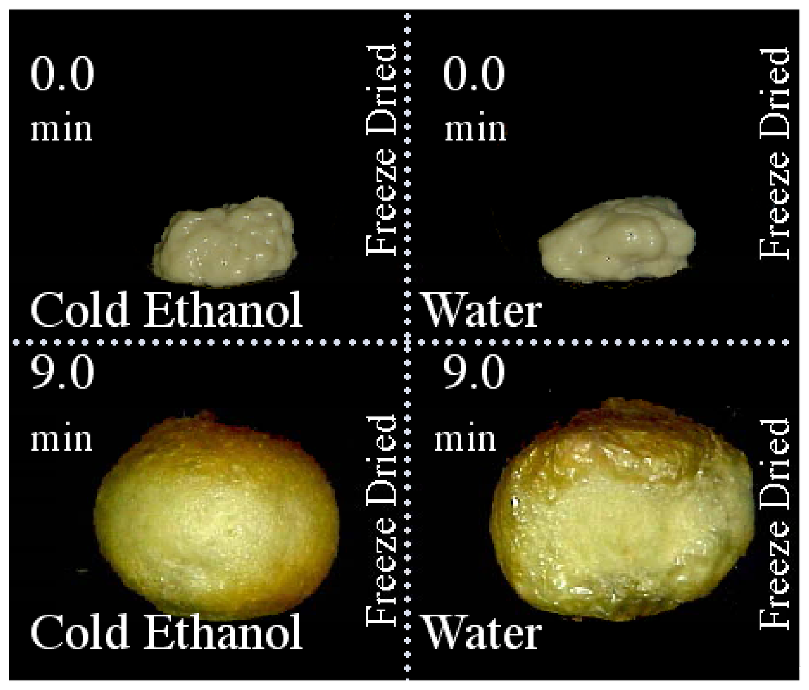

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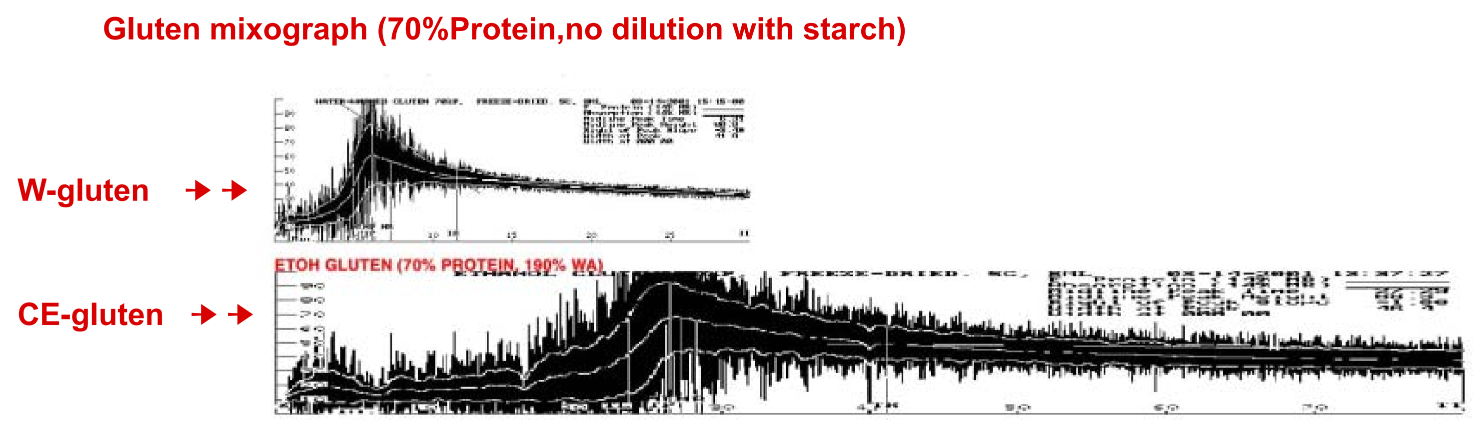

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